

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: GAECHTER, Jean-Pierre

SERIAL NO.: (International Serial No. PCT/FR2003/002607)

FILED: Herewith (International Filing Date: 29 August 2003)

TITLE: MECHANICAL ACTUATOR INCLUDING A HELICAL-CAM NUT

Preliminary Amendment: CLAIM AMENDMENTS

1. (Currently amended) Actuator including comprising:

a first tubular body-(20),

a nut-(70) positioned inside the tubular body-(20) and having at least a generally helical ball-race (41-51 ; 52-62) including with a helical portion extending about the nut-(70) according to an angle of less than 360 degrees and a widened portion-(81) connecting the ends of the helical portion, said widened zone-(81) portion forming a re-circulation zone for the balls (22) arranged between the ball-race (41-51, 52-62) and the inner surface-(21) of this the tubular body-(20), this actuator also including and

a driving means-(2) for rotating the nut-(70), in order to ensure the displacement in translation of the tubular body-(20) with respect to the latter; characterized in that nut, wherein the inner face-(21) of the first tubular body-(20) includes comprises helical ball-races for guiding the balls-(22).

2. (Currently amended) Actuator according to claim 1, characterized in that wherein the inner surface-(21) of the first tubular body-(20) has a helical pitch substantially equal to the helical pitch of a ball-race-(41-51, 52-62) of the nut-(70).

3. (Currently amended) Actuator according to ~~any of the preceding claims~~, characterized in that the Claim 1, wherein said nut (70) includes comprises several ball-races (41-51, 52-62), each of the ball-races having a re-circulation zone for the balls and in that the ball-races are so arranged that the re-circulation zones for the balls are not aligned in a direction of translation of the actuator.

4. (Currently amended) Actuator according to claim 3, characterized in that wherein the ball-races (41-52, 5262) are so arranged that the re-circulation zones are regularly angularly distributed about the direction of translation of the actuator.

5. (Currently amended) Actuator according to ~~any of claims 1 to 4~~, characterized in that the Claim 1, wherein said nut (70) includes comprises several aligned elements (40, 50, 60), of a cylindrical general shape, each element having at least one bevel (41, 51, 52, 62) forming a helical cam surface, the bevels (41, 51, 52, 62) forming, two by two, helical ball-races in which balls (22) are positioned.

6. (Currently amended) Actuator according to claim 5, characterized in that wherein each helical cam surface (41, 51, 52, 62) forms a setback (45, 55), and in that wherein two elements (40, 50, 60) are so positioned with respect to each other that their setbacks (45, 55) are facing each other, said setbacks forming the re-circulation zone (81) for the balls (22).

7. (Currently amended) Actuator according to claim 5, characterized in that the wherein prestressing exerted on the balls (22) is generated by tightening the elements (40, 50, 60) with respect to each other.

8. (Currently amended) Actuator according to claim 7, characterized in that it includes a further comprising: another nut for adjusting (4) the elements (40, 50, 60), in order to control the prestressing exerted on the balls (22).

9. (Currently amended) Actuator according to claim 8, characterized in that it includes further comprising: a springy means (5) interposed between the adjusting nut (4) and the elements (40, 50, 60) of the nut (70), through which the adjusting nut (4) exerts a prestressing on the elements (40, 50, 60).

10. (Currently amended) Actuator according to one of claims 3 to 9, characterized in that Claim 3, wherein each element (40, 50, 60) is formed from comprised of a cylindrical part with a straight cross-section (400), one circular edge of which is thereof being beveled; in order to form and forming said helical cam surface inclined with respect to the axis (401) of the cylindrical part (400), the ends of the helical surface being connected by a setback surface (45) of a conical general shape.

11. (Currently amended) Actuator according to claim 10, characterized in that wherein the ball-race (41-51, 52-62) includes is comprised of a widened re-circulation zone (81) for the balls (22) defined by the setback surfaces of two elements (40, 50), the setback surfaces being positioned in front of each other, in an opposite way.

12. (Currently amended) Actuator according to any of the preceding claims, characterized in that the Claim 1, wherein said driving means (2) for driving the nut (79) include comprises a motor mounted fixed inside a second tubular body (10) capable of, being driven drivable in translation with respect to the first tubular body (20).

13. (Currently amended) Actuator according to one of claims 1 to 12, characterized in that Claim 1, wherein the ball-races at the level of the inner surface (21) of the tubular body (20) are formed by comprised of plastic distortion of this the inner surface (21) by the balls (22), followed by a treatment for hardening this inner surface (21) of the tubular body (20).

14. (Currently amended) Actuator according to ~~any of claims 1 to 12, characterized in that~~
Claim 1, wherein the ball-races at the level of the inner surface (21) of the first tubular body (20) are
~~formed by comprised of~~ at least one wire (91) positioned in the shape of a spiral inside the first
tubular body (20).

15. (Currently amended) Actuator according to claim 14, ~~characterized in that it includes~~
further comprising: a first wire (91) positioned in the shape of a spiral inside the first tubular body
(20), on which the balls (22) rest, and a second intercalated wire (92) having a diameter smaller than
that of the first wire (91) and extending between the windings of the first wire (91), ~~this said~~ second
wire (92) maintaining the separation between the windings of the first wire (91).

16. (Currently amended) Actuator according to ~~one of claims 1 to 12, characterized in that~~
~~it includes~~ Claim 1, further comprising: an inner tube (93) arranged in the tubular body (20) and
welded to the ~~latter~~ tubular body, the inner tube (93) having ball-races carried out by burnishing.

17. (Currently amended) Actuator according to ~~one of the preceding claims, characterized~~
~~in that it has~~ Claim 1, further comprising: a third tubular body (300), the first tubular body (20) being
connected to a second nut (370), ~~the~~ rotation of the second nut (370) causing the displacement in
translation of the third body with respect to the first tubular body (20), the actuator thus constituting
an actuator of the telescopic type.

18. (Currently amended) Actuator according to ~~one of the preceding claims, characterized~~
~~in that~~ Claim 1, wherein the first tubular body (20) is made out comprised of aluminum, KEVLAR®,
carbon fibers or molded plastic.